

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of : :

John Gough ERRINGTON *et al.* : Confirmation No. -----

International Application No. PCT/NZ04/00305 : Group Art Unit: -----

Filed: November 26, 2004 : Examiner: -----

For: METHOD AND APPARATUS FOR PRODUCING BIO-DEGRADABLE FOAM

**PRELIMINARY AMENDMENT**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Preliminary to examination of the above-referenced application, please amend the application as follows:

**AMENDMENTS TO THE SPECIFICATION:**

*On page 1 after the title, please insert the following:*

-- RELATED APPLICATIONS

The present application is based on, and claims priority from, International Application Number PCT/NZ04/00305, filed November 26, 2004, which claims priority from New Zealand Application Number 529803, November 27, 2003, the disclosures of which are hereby incorporated by reference herein in their entirety. --

**Abstract**

*Please insert the following Abstract:*

**ABSTRACT**

Methods, associated products and apparatus are described for the production of biodegradable foam products using a controlled pressure increase due to compressed air and a controlled pressure decrease in pressure as key variables during a microwave heating cycle to produce a foamed product. The biodegradable product formed has improved characteristics including a density from 10 to 100 kg/m<sup>3</sup>; a soft and resilient structure; cushioning G-value characteristics to cushion an object with a fragility of 15 to 115; and a surface abrasion comparable to polystyrene.

**IN THE CLAIMS:**

This listing of claims will replace all prior versions and listings of claims in the application:

**Listing of Claims:**

1. **(currently amended)** A method of producing a biodegradable foamed product including the steps of:
  - (a) placing a raw biodegradable material into a mould;
  - (b) locating the mould in a microwave cavity;
  - (c) conducting a microwave heating cycle;  
~~characterised~~characterized in that during step (c) the raw material is subjected to at least one controlled pressure increase and decrease using a compressed gas.
2. (original) The method of claim 1 wherein the compressed gas is air.
3. **(currently amended)** The method of~~either~~ claim 1~~or claim 2~~ wherein the compressed gas is not pre-treated.
4. **(currently amended)** The method as claimed in~~any of the above claims~~claim 1 wherein the raw biodegradable material is derived from starch, cellulose, protein or a derivative of starch, cellulose, or protein and combinations thereof.
5. **(currently amended)** The method as claimed inclaim 1~~any of the above claims~~ wherein the raw material has a moisture content in the order of 15 to 50% wt.
6. **(currently amended)** The method as claimed inclaim 1~~any of the above claims~~ wherein the raw biodegradable material is pre-formed by a heat and shear process into pellets.
7. **(currently amended)** The method as claimed inclaim 1~~any of the above claims~~ wherein step (c) is completed in under one minute.

8. **(currently amended)** The method as claimed in claim 1~~any of claims 1 to 6~~ wherein step (c) is completed in the order of 30 seconds.

9. **(currently amended)** The method as claimed in claim 1~~any of the above claims~~ wherein the increased pressure is maintained for over half of the duration of step (c).

10. **(currently amended)** The method as claimed in claim 1~~any of the above claims~~ wherein the raw material is subjected to a pressure of between 1.5 and 100 bar during step (c).

11. **(currently amended)** The method as claimed in claim 1~~any of claims 1 to 9~~ wherein the raw material is subjected to a pressure of between 3 and 20 bar during step (c).

12. **(currently amended)** The method as claimed in claim 1~~any of the above claims~~ wherein microwave heating continues after the pressure is decreased during step (c).

13. **(currently amended)** The method as claimed in any of the above claims~~claim 1~~ wherein the pressure decrease occurs at a rate of 0.001 to 200 bar per second.

14. **(currently amended)** The method as claimed in any of the above claims~~claim 1~~ wherein the pressure is decreased rapidly at a rate of 0.5 to 10 bar per second during step (c).

15. **(currently amended)** The method as claimed in any of the above claims~~claim 1~~ wherein the timing and rate of pressure decrease is matched to the temperature profile for the raw material.

16. **(currently amended)** The method as claimed in any of the above claims~~claim 1~~ wherein the pressure decreases within 0.1 to 10 seconds.

17. **(currently amended)** The method as claimed in any of the above claims~~claim 1~~ wherein the pressure decrease occurs as one continuous pressure drop.

18. **(currently amended)** The method as claimed in ~~any of the above claims~~claim 1 wherein the pressure decrease commences in the last half of the overall time to complete step (c).

19. **(currently amended)** The method as claimed in ~~any of the above claims~~claim 1 wherein the raw material is subjected to a pressure increase before step (c) commences.

20. **(currently amended)** The method as claimed in ~~any of the above claims~~claim 1 wherein the raw material is preheated before step (c) commences.

21. (original) The method as claimed in claim 20 wherein the raw biodegradable material is preheated to a temperature below the raw biodegradable material melt temperature.

22. **(currently amended)** The method as claimed in ~~any of the above claims~~claim 1 wherein the mould is substantially microwave transparent and is coated with a susceptor material.

23. **(currently amended)** The method as claimed in ~~any of the above claims~~claim 1 wherein the mould includes vents.

24. **(currently amended)** A biodegradable foamed product produced in accordance with the method as claimed in ~~claim 1~~any of claims 1 to 23.

25. **(currently amended)** A biodegradable foamed product with a thickness of up to approximately 1—metre manufactured from a biodegradable raw material with properties including ~~meter produced by a microwave heating cycle during which the biodegradable raw material is subjected to at least one controlled pressure increase and decrease using a compressed gas and characterized in that the resulting product has properties including:~~

- (a) a density from 10 to 100kg/m<sup>3</sup>;
- (b) a soft and resilient structure;
- (c) cushioning G-value characteristics to cushion an object with a fragility of 15 to 115;
- (d) a surface abrasion comparable to polystyrene.

26. **(currently amended)** An apparatus for the production of a foamed product with a thickness of up to approximately 1 metre including:

- (a) a cavity;
- (b) a mould capable of containing a raw material that is able to be melt processed when subjected to heat and pressure treatment to form a foam;
- (c) at least one magnetron capable of microwave heating the raw material in a microwave heating cycle;
- (d) at least one inlet through which a compressed gas passes; and,
- e) at least one outlet for ~~depressurisation~~ depressurization;

~~characterised~~ characterized in that the apparatus is capable of subjecting the raw material to controlled pressure increases and decreases using compressed gas in conjunction with microwave heating.

27. (original) The apparatus as claimed in claim 26 wherein the compressed gas is air.

28. **(currently amended)** The apparatus as claimed ~~in either claim 26 or claim 27 in claim 26~~ wherein the apparatus further includes a sealed chamber within which the mould and raw material are placed, the chamber is positioned inside the apparatus cavity, and the chamber containing the mould and raw material, is ~~pressurised~~ pressurized.

29. **(currently amended)** The apparatus as claimed in ~~any of claims 26 to 28~~ claim 26 wherein the outlet is a valve.

30. **(currently amended)** The apparatus as claimed in ~~any of claims 26 to 29~~ claim 26 wherein the magnetrons are capable of heating the raw material at a rate of up to 25°C per second.

31. **(currently amended)** The apparatus as claimed in ~~any of claims 26 to 30~~ claim 26 wherein the magnetrons operate at a frequency from approximately 915 MHz to 5 GHz.

32. **(currently amended)** The apparatus as claimed in ~~any of claims 26 to 30~~ claim 26 wherein the magnetrons operate at a frequency of an approximately constant level of 2450 MHz.

33. **(currently amended)** The apparatus as claimed in ~~any of claims 26 to 32~~ claim 26 wherein the apparatus includes at least one pressure window manufactured from a substantially microwave transparent material and located between a waveguide exit point and the cavity.

34. (original) The apparatus as claimed in claim 33 wherein the window includes a sacrificial window.

35. **(currently amended)** The apparatus as claimed in ~~any of claims 26 to 34~~ claim 26 wherein the apparatus includes an injection point through which raw material can be inserted into the mould.

36. **(currently amended)** The apparatus as claimed in ~~any of claims 26 to 35~~ claim 26 wherein the mould is substantially microwave transparent and is coated with a susceptor material.

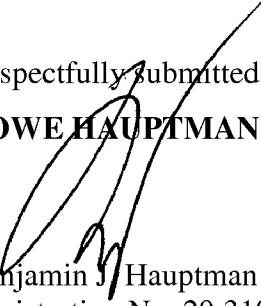
**REMARKS**

The above-referenced application is amended to incorporate by reference the corresponding New Zealand applications by references. The claims have been amended to remove multiple dependencies and to better define the claimed invention. An abstract has been added.

Entry is in order.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 07-1337 and please credit any excess fees to such deposit account.

Respectfully submitted,  
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